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Bibliography of Technical Reports and Articles Covering Complete AERIAL DELIVERY RESEARCH ACTIVITIES Conducted at the ARMED FORCES FOOD AND CONTAINER INSTITUTE

by

Edward H. Schembor

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ARMED FORCES FOOD AND CONTAINER INSTITUTE
U.S. ARMY QUARTERMASTER RESEARCH AND ENGINEERING CENTER
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After the fall of 1963 requests for further information on the work should be directed to the Container Division, U.S. Army Laboratories, Natick, Mass. Inter-library loan requests, in the event difficulty is encountered through normal channels, should be addressed to the Technical Library, U.S. Army Laboratories, Natick, Mass.

WALTER L. NECKER
Chief, Library Branch
Armed Forces Food and Container Institute

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ABSTRACT

This bibliography presents a complete compilation of technical reports and articles concerning studies conducted in the field of aerial delivery by the Armed Forces Food and Container Institute during the period from 1954 through 1962.

The Institute's primary mission in aerial delivery was to assist the Quartermaster Research and Engineering Center in the design and development of systems and procedures for the aerial delivery of supplies and equipment. The reports and articles in this bibliography represent the accomplishments of both the in-house and contract phases of the program. In general, the reports deal with the following activities:

a. Investigation of the static and dynamic properties of energy absorbers.

b. Design and development of shock recording devices.

c. Development of drop test facilities and instrumentation.

d. Design and development of high velocity aerial delivery systems.

AERIAL DELIVERY TECHNICAL REPORTS

T. R. 48. Design and Development of Special Purpose Containers, Memorandum: Survey of Aerial Delivery Practices, 12 March 1954, University of Texas, Container Research Laboratory, Austin, Tex. (Contract No. DA11-009-qm-19309). 8 p. 1.

This survey presents the status of research on aerial delivery in military services and other agencies.

T.R. 55. A Program for Aerial Delivery Research and Development at the Quartermaster Food and Container Institute, 27 August 1954, R. H. Witting, 9 p. 2.

A proposed research program in aerial delivery.

T.R. 56. Shock Recording Device for Aerial Delivery Research, Report No. 1, 31 August 1954, Southwest Research Institute, Physics Dept., San Antonio, Texas (Contract No. DA 19-129-qm-130) 6 p. 3.

Proposed approach for design and development of a shock recording device.

T.R. 57. Export Packaging Study for Aerial Delivery Planning, 1 Sept. 1954, R. J. Heick, 103 p. (AD-237076). 4.

Lists the export packaging information on certain Army supply and equipment items known to have been airdropped during the Korean conflict.

T.R. 59. Shock Recording Device for Aerial Delivery Research, Report No. 2, 31 October 1954, Southwest Research Institute, Physics Dept., San Antonio, Tex. (Contract No. DA 19-129-qm-130) 18 p. il. 5.

Results of drop tests to establish operational parameters for design and development of a self-recording accelerometer.

T.R. 60. Shock Recording Device for Aerial Delivery Research, Phase Report, 15 Jan. 1955, Southwest Research Institute Physics Dept., San Antonio, Tex. (Contract No. DA 19-129-qm-130) 16 p. il. 6.

Specifications for a shock measuring and recording device and design sketches of a proposed magnetic recording accelerometer.

T.R. 65. Supplement to: Export Packaging Study for Aerial Delivery Planning, 23 March 1955, R. J. Heick, 23 p. (AD-238-473) 7.

Supplement to Technical Report No. 57 containing additional packaging information for supply items and equipment.

T.R. 68. Shock Recording Device for Aerial Delivery Research, Report No. 4, 1 April 1955, Southwest Research Institute, Physics Dept., San Antonio, Tex. (Contract No. DA 19-129-qm-130) 7 p. il. 8.

Discussion of the design and fabrication of sensing and recording unit and design of record transport and storage unit.

T.R. 70. Dynamic Energy Absorbing Characteristics of Paper Honeycomb Determined by Airdrop, Airdrop No. 1, 29 April 1955, R. J. Heick, 18 p. il. (AD-73431). 9.

Evaluation of the dynamic energy absorbing characteristics of paper honeycomb by using the material in an aerial delivery system.

T.R. 74. Dynamic Energy Absorbing Characteristics of Paper Honeycomb Determined by Airdrop, Airdrop No. 2, 6 May 1955, R.J. Heick, 27 p. il. (AD-73432). 10.

Evaluation of the dynamic energy absorbing characteristics of paper honeycomb by using the material in an aerial delivery system and airdropping. Retarded and free-fall drops were performed.

T.R. 76. Shock Recording Device for Aerial Delivery Research, Report No. 5, 31 May 1955, Southwest Research Institute, Physics Dept., San Antonio, Tex. (Contract No. DA 19-129-qm-130) 2 p. 11.

Discussion of the fabrication the sensing and recording unit.

T.R. 81. Cushioning for Airdrop, Part 1, 15 July 1955, University of Texas, Container Research Laboratory, Austin, Tex. (Contract No. DA 19-129-qm-150) 80 p. il. 12.

Development and explanation of the drop test facility and instrumentation. Presents basic information on cushioning materials and a cost comparison between retarder and cushioning.

T.R. 84. A Design Analysis of Attitude Control Systems Applicable to Airdropped Packaging, Bi-Monthly Report No. 1, 1 August 1955, Midwest Research Institute, Kansas City, Mo., G. B. White and S.M. Zivi. (Contract No. DA 19-129-qm-415) 13 p. il. (AD-71268) 13.

Initial report of the literature survey to investigate devices that are classified as a retarded falling store.

T.R. 85. Shock Recording Device for Aerial Delivery Research, Report No. 6, 5 August 1955. Southwest Research Institute, Physics Dept., San Antonio, Tex. (Contract No. Da 19-129-qm-130) 8 p. il. 14.

Report of the fabrication and assembly of nearly all the components for the sensing and recording unit, and of preliminary tests to prove the feasibility of the recording system with visible presentations of magnetic boundary displacement recording.

T.R. 90. Evaluation of Foamglass Cushioning Material. 1 Sept. 1955, A. Miller, 1 p. 15.

Determination of the force-compression characteristics of foamglass.

T.R. 93. Development of a Method for Rational Design of Airdrop Packaging. Report No. 1. 15 Sept. 1955, Penn. State University, Engineering Research Dept., University Park, Pa. (Contract No. 19-129-qm-386) 46 p. 16.

Initial report of the project organization and progress of the literature search.

T.R. 94. Guided Vertical Free-Fall Drop tests for Aerial Delivery of 5-in-1 and C-Rations, Protected with Paper Honeycomb. 16 Sept. 1955, R. H. Witting, 26 p. il. (AD-237447). 17.

Determination of the effectiveness of paper honeycomb material for protecting C- and 5-in-1 rations against impact forces by guided free-fall drop tests.

T.R. 95. Guided Vertical Free-Fall Drop Tests of 5-gallon Gasoline Cans and 55-Gallon Drums. 30 Sept. 1955, R. H. Witting, 10 p. il. (AD-89814). 18.

Determination of the effectiveness of paper honeycomb material for protecting 5-gallon gasoline cans and 55-gallon drums by guided free-fall drop tests.

T.R. 96. A Design Analysis of Attitude Control System Applicable to Airdropped Packaging. Bi-Monthly Report No. 2. 1 October 1955, Midwest Research Institute, Kansas City, Mo., (Contract No. DA 19-129-qm-415) 16 p. il. 19.

Three ideas for attitude control systems are presented.

T.R. 98. Dynamic Energy Absorbing Characteristics of Paper Honeycomb Determined by Airdrops. Airdrop No. 3, 13 Oct. 1955, R.J. Heick, 13 p. il. (AD-89811). 20.

Evaluation of the dynamic energy absorbing characteristics of paper honeycomb material by incorporating the material in an aerial delivery system.

T.R. 99. Dynamic Energy Absorbing Characteristics of Paper Honeycomb Determined by Airdrop, Airdrop No. 4, 14 Oct. 1955, R. J. Heick, 13 p. il. (AD-89812). 21.

Evaluation of the dynamic energy absorbing characteristics of paper honeycomb material by incorporating the material in displaced center of gravity aerial delivery systems.

T.R. 100. Shock Recording Device for Aerial Delivery Research, Progress Letter, 17 Oct. 1955, Southwest Research Institute, Physics Dept., San Antonio, Tex. (Contract No. DA 19-129-qm-130) 2 p. 22.

Explanation of the design of the tape transport unit and the start-stop actuating unit.

T.R. 103. A Design Analysis of Attitude Control Systems Applicable to Airdropped Packaging, Special Report No. 1, 1 Nov. 1955, Midwest Research Institute, Kansas City, Mo., (Contract No. DA 19-129-qm-415), 21 p. il. 23.

Presentation of the performance analysis of four parachutes, the G-I-A. G-13, and the 15-foot and 24-foot extraction parachutes.

T.R. 104. Development of a Method for Rational Design of Airdrop Packaging, Report No. 2, 15 Nov. 1955, Penn. State University, Engineering Research Dept., University Park, Pa. (Contract No. DA 19-129-qm-386) 41 p. il. 24.

Summary of the literature search and details of various trips in regard to the contract.

T.R. 106. A Design Analysis of Attitude Control Systems Applicable to Airdropped Packaging, Bi-Monthly Report No. 3, 1 Dec. 1955, Midwest Research Institute, Kansas City, Mo., (Contract No. DA 19-129-qm-415) 21 p. il. 25.

Presents a theoretical analysis of an ideal attitude control device.

T.R. 108. Dynamic Energy Absorbing Characteristics of Paper Honeycomb Determined by Airdrops, Airdrops No. 5 and 6. 12 Dec. 1955, R. J. Heick, 14 p. il. (AD-89813). 26.

Determination of the dynamic energy absorbing characteristics of paper honeycomb material by incorporating the material in free-fall aerial delivery systems.

T.R. 109. Cushioning for Airdrop, Part II, Airdrop Cost Analysis. 19 Dec. 1955, University of Texas, Container Research Laboratory, Austin, Texas (Contract No. DA 19-129-qm-150) 37 p. il. 27.

Development and interpretation of the fundamental equations for the cost of airdrops involving the use of retarders alone, and the use of a combination of retarders and cushioning as a means of absorbing the kinetic energy of falling bodies. Optimum drop velocities are established.

T.R. 110. Dynamic Energy Absorbing Characteristics of Paperboard Honeycomb Material as Determined by Laboratory Tests, 21 Dec. 1955, W. D. Bowers, 24 p. il. 28.

Dynamic characteristics of grades 1, 3, 5, and 6 paper honeycomb material are determined by drop tests.

T.R. 111. Investigation of Packaging Materials and Techniques in Aerial Delivery of Supplies, Bi-Monthly report, 22 Dec. 1955, University of Texas, Container Research Laboratory, Austin, Texas (Contract No. DA 19-129-qm-150) 2 p. 29.

Status of research is reported.

T.R. 112. Equilibrium Moisture Content of Paper Honeycomb and its Effect on Energy Absorption, Phase Report No. 1, 31 Dec. 1955, Forest Products Laboratory, Madison, Wis. 30 p. il. 30.

The effect of moisture on the crushing strength and energy absorption of paper honeycomb pads designed for use as cushioning in aerial delivery of supplies and equipment is determined.

T.R. 113. Development of a Method for Rational Design of Airdrop Packaging, Report No. 3, 31 Dec. 1955, Penn State University, Engineering Research Dept., University Park, Pa. (Contract No. DA 19-129-qm-386) 84 p. il. 31.

Progress on the literature search and experimental work on instrumentation is discussed. Also included is a group of trip reports.

T.R. 114. A Design Analysis of Attitude Control Systems Applicable to Airdropped Packaging, Phase 1 Report, Literature Survey, Vol. 1, 1 Feb. 1956, Midwest Research Institute, Kansas City, Mo. (Contract No. DA 19-129-qm-415) 83 p. il. 32.

A literature survey comprising the more important articles and patents published on subjects pertaining to attitude control devices for aerial delivery systems, either free-fall or retarded-fall, is presented.

T.R. 117. High Velocity Aerial Delivery Systems for Four 55-Gallon Drums. 9 Feb. 1956, R. J. Heick, 31 p. il (AD-89815) 33.

Experimental data for the design of a high velocity aerial delivery system for four 55-gallon drums utilizing paper honeycomb as the energy absorber and a 24-foot diameter horizontal ribbon extraction parachute as the stabilizer.

T.R. 118. Aerial Delivery System for Combat Rations with Paper Honeycomb as an Energy Absorbing Material. 9 Feb. 1956, B.H. Roffee, 56 p. il. (AD-100487). 34.

Experimental data for the design of a high velocity aerial delivery system for 48 cases of combat rations utilizing paper honeycomb as the energy absorber and a 24-foot diameter horizontal ribbon extraction parachute as the stabilizer.

T.R. 119. First Progress Report on Analysis and Tests of Cellular Paper Structures. Progress Report No. 2, 29 Feb. 1956, Forest Products Laboratory, Madison, Wisc., (Project Order 56-2) 6 p. 35.

Stress analysis of cellular paper cushioning materials.

T.R. 121. Development of a Method for Rational Design of Airdrop Packaging, Report No. 4., 15 March 1956, Penn. State University, Engineering Research Dept., University Park, Pa. (Contract No. DA 19-129-qm-386) 52 p. il. 35a.

A theoretical investigation of the dynamics of a rectangular box striking a flat plate at an angle, intended to verify Mindlin's theory. Requirements for evaluating the Convair accelerator and of an impact machine.

T.R. 122. Research on Experimental High Velocity Aerial Delivery Systems. Aircrop No. 7. 24 April 1956, R.J. Heick, 13 p. il. 36.

Results of airdrop tests of experimental high velocity aerial delivery systems of 55-gallon drums and combat and 5-in-1 rations.

T.R. 123. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 12. 26 April 1956, R.J. Heick, 13 p. il. 37.

Results of airdrop tests of experimental high velocity aerial delivery systems and standard aerial delivery systems for 55-gallon drums, and combat and 5-in-1 rations.

T.R. 124. Second Progress Report on Analysis of Tests of Cellular Paper Structures. Progress Report No. 3. 30 April 1956, Forest Products Laboratory, Madison, Wisc. (Project Order 56-2) 31 p. il. 38.

Results of tests of two cellular paper structures that were statically loaded in compression at various angles to the cell axes.

T.R. 126. Development of a Method for Rational Design of Airdrop Packaging. Report No. 5, 15 May 1956, Penn. State University, Engineering Research Dept., University Park, Pa. (Contract No. DA 19-129-qm-386) 67 p. 39.

Theoretical work on the study of the dynamic characteristics of a rectangular box, on the application of MacGregor's two-load method of impact testing and on the dynamic loading of columns. Also discussed are some experimental work on the evaluation of the accuracy of instrumentation for Riehle machine; the development of instrumentation for dynamic force measurement for Riehle machine; and instrumentation of HYGE accelerator.

T.R. 127. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 10, 18 May 1956, R. J. Heick, 9 p. il. 40.

Results of airdrop tests of experimental high velocity aerial delivery systems for combat rations and 55-gallon drums.

T.R. 128. Shock Recording Device for Aerial Delivery Research. Progress Letter, 22 May 1956, Southwest Research Institute, Physics Dept. San Antonio, Texas. (Contract No. DA 19-129-qm-130) 2 p. 41.

Several minor modifications to be performed on the shock recorder are described.

T.R. 129. Shock Recording Device for Aerial Delivery Research. Report No. 7., 31 May 1956, Southwest Research Institute, Physics Dept., San Antonio, Texas (Contract No. DA 19-129-qm-130) 12 p. il. 42.

Evaluation of initial calibration and field tests on the shock recorder.

T.R. 130. Shock Recording Device for Aerial Delivery Research. Report No. 8, 31 July 1956, Southwest Research Institute, Physics Dept., San Antonio, Texas (Contract No. DA 19-129-qm-130) 10 p. il. 43.

Evaluation of a second series of field tests on the shock recorder.

T.R. 131. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 11, 5 July 1956, R.J. Heick, 13 p. il. 44.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat rations.

T.R. 132. Development of a Method for Rational Design of Airdrop Packaging. Report No. 6, 15 July 1956, Penn State University, Engineering Research Dept., University Park, Pa. (Contract No. DA 19-129-qm-386) 40 p. 45.

A study of existing mathematical methods for study of structures subject to impulsive loading and a discussion of experimental work on instrumentation.

T.R. 133. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 13, 16 July 1956, R.J. Heick, 11 p. il. 46.

Results of airdrop tests of experimental high velocity and standard aerial delivery systems for 55-gallon drums and combat rations.

T.R. 134. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 18, 23 July 1956, M. A. Venetos, 11p. il. 46a.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat rations.

T.R. 135. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop 24, 25 July 1956, R.J. Heick, 13 p. il. 47.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-gallon gasoline cans and combat rations.

T.R. 136. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 25, 27 July 1956, R.J. Heick, 18 p. il. 48.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-gallon gasoline cans and dummy caliber 0.30 ammunition and displaced center of gravity systems for combat rations.

T.R. 138. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 8, 21 August 1956, B.H. Roffee, 19 p. il. 49.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat and 5-in-1 rations.

T.R. 139. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 16, 6 September 1956, R.J. Heick, 10 p. il. 50.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums, 5-gallon gasoline cans and combat rations.

T.R. 140. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 9, 11 Sept. 1956, R.J. Heick, 8 p. il. 51.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat rations.

T.R. 141. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 14, 12 Sept, 1956, R.J. Heick, 17 p. il. 52.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat and 5-in-1 rations, and of standard aerial delivery systems for combat rations.

T.R. 142. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 15, 18 September 1956, R. J. Heick, 16 p. il. 53.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums, 5-gallon gasoline cans and combat rations.

T.R. 143. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 17, 20 September 1956, R. J. Heick, 12 p. il. 54.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and 5-gallon gasoline cans.

T.R. 144. Laboratory Instrumentation on the Dynamic Testing of Energy Absorbing Material. 2 October 1956, S. D. Coleman, Jr. 74 p. il. 55.

A discussion of the Institute test facilities and electronic instrumentation that were developed for the purpose of investigating the dynamic properties of materials to be used in aerial delivery.

T.R. 145. Energy Absorbing Characteristics of Honeycomb Paperboard Statically compressed at Various Angles to the Longitudinal Axes of the Cells. 15 October 1956, E. J. Pulo and A. Miller, 20 p. il. 56.

Static compression test data for five grades of double-faced honeycomb whose cell axes were inclined at 20^{o} and 40o with the vertical.

T.R. 146. Research on the Use of Paperboard Honeycomb as an Energy Absorber in Drop Tests of a One-Quarter Ton Truck. 16 October 1956, D. J. Crimmins, 30 p. il. 57.

Results of drop tests of a jeep from heights of 10, 16, and 25 feet. The jeep was protected in all drops with a crushable energy absorber.

T.R. 147. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 22, 18 October 1956, R. J. Heick, 9 p. 58.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-in-1 rations and a design of a partial-area energy absorber.

T.R. 148. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 23, 24 October 1956, R. J. Heick, 20 p. il. 59.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and 5-in-1 and combat rations and a design of a partial-area energy absorber.

T.R. 149. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 26, 8 May 1956, G.B. White, 15 p. 60.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-gallon gasoline cans and dummy small arms ammunition.

T.R. 151. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 27, 27 December 1956, G.B. White, 19 p. il. 61.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-in-1 rations and dummy small-arms ammunition and a design of a partial-area energy dissipator.

T.R. 152. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 28, 31 December 1956, G.B. White, 16 p. il. 62.

Results of airdrop tests of experimental high velocity aerial delivery systems for 5-in-1 rations and dummy small-arms ammunition.

T.R. 153. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 31, 8 January 1957, G.B. White and R. J. Heick, 19 p. il. 63.

Results of airdrop tests of experimental high velocity aerial delivery systems for inert ammunition (57 mm cartridges, 76 mm shells, 81 mm mortar shells, 90 mm cartridges and 105 mm shells) and 55-gallon drums.

T.R. 155. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 19, 3 April 1957, E.F. Williams, 15 p. il. (AD-238474). QMFCIAF Report 6-57. 64.

Results of airdrop tests of experimental high velocity aerial delivery systems for combat rations.

T.R. 156. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 29, May 1957, G.B. White and R.J. Heick, 28 p. il. QMFCIAF Report 4-57. 65.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums, dummy caliber 0.30 cartridges and small detachment (5-in-1) rations.

T.R. 157. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 30, April 1957, G.B. White and R.J. Heick, 20 p. il. (AD-237498). 66.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55- gallon drums, small detachment (5-in-1) rations and dummy caliber 0.30 cartridges.

T.R. 158. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 32, June 1957, G.B. White and R.J. Heick, 20 p. il. (AD-221455). QMFCIAF Report 10-57. 67.

Results of airdrop tests of experimental high velocity aerial delivery systems for inert ammunition (57 mm cartridges, 76 mm shells, 81 mm mortar shells, 90 mm cartridges and 105 mm shells).

T.R. 159. Research on Experimental High Velocity and Aerial Delivery Systems. Airdrop No. 34, May 1957. G.B. White and R. J. Heick, 16 p. il. QMFCIAF Report 5-57. 68.

Results of airdrop tests of experimental high velocity aerial delivery systems for small detachment (5-in-1) rations.

T.R. 160. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 35, June 1957, G.B. White and R. J. Heick, 20 p. il..(AD-221-456). QMFCIAF Report 11-57. 69.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums, small detachment (5-in-1) rations and inert ammunition (57 mm cartridges and 81 mm mortar shells).

T.R. 161. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 36, June 1957, G.B. White and R.J. Heick, 20 p. il. (AD-221-458). QMFCIAF Report 7-57. 70.

Results of airdrop tests of experimental high velocity aerial delivery systems for inert ammunition (57 mm cartridges, 81 mm mortar shells, 90 mm cartridges and 105 mm shells).

T.R. 162. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 37, July 1957, G.B. White and R.J. Heick, 13 p. il. (AD-219651). QMFCIAF Report No. 12-57. 71.

Results of airdrop tests of experimental high velocity aerial delivery systems for small detachment (5-in-1) rations.

T.R. 164. Static Compression Tests on Lockfoam and Beer Cans. 4 April 1957, A. Miller, 6 p. 72.

Static stress-strain curves are given for Lockfoam, Lockfoam expanded over beer cans, and beer cans.

T.R. 165. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 33, October 1957, G.B. White and R.J. Heick, 42 p. il. (AD-219654). QMFCIAF Reprt No. 18-57 73.

Results of airdrop tests of experimental high velocity aerial delivery systems for inert ammunition (57 mm cartridges, 76 mm shells, 81 mm mortar shells, 90 mm cartridges and 105 mm shells) and dummy caliber 0.30 cartridges.

T.R. 166. Shock Recording Device for Aerial Delivery Research. Progress Letter, 11 April 1957, Southwest Research Institute, San Antonio, Texas (Contract No. DA 19-129-qm-130) 2 p. 74.

Brief summary of contract status.

T.R. 167. Static Force-Deflection Data on Various Energy Absorbers. 12 April 1957, A. Miller, 22 p. il. 75.

Static stress-strain curves are given for the following materials: paper honeycomb, corrugated fiberboard blocks, foamglass, polystyrene, beer cans, aluminum honeycomb, Styrofoam and Dylite.

T.R. 170. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 20, August 1957, E.F. Williams, 17 p. il. (AD-219653). QMFCIAF Report No. 14-57. 76.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums and combat rations.

T.R. 171. Research on Experimental High Velocity Aerial Delivery Systems. Airdrop No. 21, August 1957, E.F. Williams, 35 p. il. (AD-219652). QMFCIAF Report 13-57. 77.

Results of airdrop tests of experimental high velocity aerial delivery systems for 55-gallon drums, small detachment (5-in-1) rations and water filled No. 2½ cans.

T.R. 172. Static Compression Tests of Honeycombed Paperboard. August 1957, E. J. Pulo, 26 p. il. QMFCIAF Report No. 24-57. 78.

Static stress-strain and energy-strain curves are given for five grades of paper honeycomb that were subjected to a 73 degree F., 50 percent relative humidity atmosphere.

T.R. 173. Shock Recording Device for Aerial Delivery Research. Progress Report No. 9, July 1957, Southwest Research Institute, San Antonio, Texas (Contract No. DA 19-129-qm-130), 5 p. il. 79.

Details of several modifications and results of additional dynamic and static calibration tests are presented.

T.R. 175. Dynamic Properties of Energy Absorbers that are considered for use in Aerial Delivery. June 1958, D. J. Crimmins, 31 p. il. (AD-219659). 80.

Dynamic stress-strain and energy-strain curves are given for three grades of paper honeycomb, beer cans, and styrofoam.

T.R. 176. Static Compression Tests on Paper Honeycomb with High Moisture Content. Jan. 1958, E. J. Pulo, 24 p. il. 81.

Static stress-strain and energy-strain curves for five grades of paper honeycomb after being subjected to a 24 hour water immersion of 100 degrees F.

T.R. 177. Aerial Delivery Systems for Small Detachment (5-in-1) Rations with Paper Honeycomb as an Energy Dissipator Material. Termination Report, G. B. White. 82.

Results of airdrop tests of experimental high velocity aerial delivery systems for small detachment (5-in-1) rations.

T.R. 178. Determination of Design Principles to be Employed in the Development of Ration Packs for Aerial Delivery. M.A. Venetos, 32 p. il. (AD-219658). 83.

The main factors to be considered in the design of can packs for aerial delivery are presented. Various 5-in-1 ration pack re-designs are evaluated and their force levels given.

T.R. 180. The Determination of Strength of Items for Aerial Delivery Systems Design Purposes Using a Centrifuge. 15 October 1957, E. C. Myers, 37 p. il. (AD-219656). QMFCIAF Report No. 35-57. 84.

A 35-foot centrifuge was used to determine accelerations required to cause failure of army supplies. Results show good correlation with data obtained dynamically. Design values for maximum allow-able force are suggested for rations and fuel cans.

T.R. 183. Static Compression Tests of Lockfoam and Beer Cans. 8 July 1957, A. Miller, 8 p. il. 85.

Combinations of a foamed plastic and metal cans were tested in static compression to determine their energy absorbing properties. The addition of foamed plastic reduced the initial high peak force normally associated with empty metal cans alone.

T.R. 184. Static Compression Tests of Lockfoam and Beer Cans. 5 November 1957, A. Miller, 22 p. il. 86.

Combinations of a foamed plastic and metal cans were tested in static compression to determine their energy absorbing properties. The addition of foamed plastic reduces the initial high peak force normally associated with empty metal cans alone.

T.R. 185. Wood Blocks as Energy Absorbers. 24 October 1957, H. E. Staph, University of Texas, Structural Mechanics Research Lab., (Contract DA 19-129-qm-287). 88 p. il. 87.

The capacity of wood for absorbing impact energy and also the principles which should govern the design of wood blocking for effective energy absorption have been studied.

Average stress-strain curves are presented for impacts on small blocks of dense Southern Yellow Pine. The effects of variations in the weight of the impacting mass, the impact velocity, block dimensions, and moisture content of the wood are shown. The efficiency is essentially independent of the size of the impacting mass and the impact velocity, so long as the block is large enough to absorb all the impact energy without "bottoming." It is found that except at the two extremes of moisture content, very dry or very wet, moisture content does not greatly affect energy-absorbing efficiency.

A design criteria for theuse of wood blocking as cushioning is presented.

T.R. 189. Static Compression Tests on Lockfoam and Beer Cans. 11 December 1957, A. Miller, 26 p. il. 88.

Continuation of report 184 dated 5 November using up to 15 inches thickness of Lockfoam under beer cans in static compression tests.

T.R. 190. Modification of "C" Ration Packs for Aerial Delivery. 18 February 1958, M.A. Venetos, 6 p. il. (AD-219657). 89.
QMFCIAF Report No. 6-58.

Description of various pack redesigns which have substantially higher resistance to damage than the standard type "C" Ration pack. Force levels are given for the standard pack as well as for redesigned packs.

T.R. 194. Theory of the Gravity Driven Pulley System Accelerator. J. P. Akrep, (Not to be published). 90.

A new method of applying falling weight with mechanical advantage through pulley systems is described to produce accelerations above normal gravity. The method is particularly adapted for developing steady state accelerations above gravity, and for increasing impact velocity.

T.R. 195. Theory of the Liquid Column Accelerometer. J. P. Akrep, March 1959, 10 p. 4 il. QMFCIAF Report No. 6-59. 91.

The use of a liquid column as the reacting mass in an accelerometer is discussed for application to measurement of impact and shock phenomena. Problem areas are outlined for further research and a self contained low cost package testing unit is proposed.

T.R. 198. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container II - Design and Evaluation of 5-in-1 Ration Load Configurations. M.A. Venetos, June 1959, 22 p. 7 il. QMFCIAF Report No. 22-59. 92.

Load configurations of 5-in-1 rations for the M-4A high speed aerial delivery container were designed and evaluated. The designs were based on item shock ratings and the dynamic characteristics of the M-4A nose cone.

T.R. 200. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container I - Design and Evaluation of "C" Ration Load Configurations. M.A. Venetos, June 1959, 20 p. 13 il. (AD-219660). QMFCIAF Report No. 14-59. 93.

Load configurations of "C" rations for the M-4A high speed aerial delivery container were designed and evaluated. The designs were based on item shock ratings and the dynamic characteristics of the M-4A nose cone.

T.R. 203. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container III - Design and Evaluation of C Ration Load Configurations. M. A. Venetos, August 1959, 27 p. il. (AD-237377). QMFCIAF Report No. 24-59. 94.

This study was concerned with the design and evaluation of load configurations of "C" rations for airdrop in the M-4A high speed aerial delivery container. Two systems were developed which permitted safe delivery of "C" rations at impact velocities of 35 feet per second. By slightly modifying one of the systems, it was possible to drop at impact velocity up to 42 feet per second.

T.R. 205. A Survey of QMC Air Cargo Problems and Their Implications for the Combat Delivery Program. J. P. Akrep, July 1960, 66p. 29 il. QMFCIAF Report No. 24-60. 95.

Discusses problems of unit load supply for tactical element support from the viewpoint of aircargo delivery by ground ejection. Evaluates problems of container dimensions and weights for compatibility with the 40 x 48 pallet, and the use of this load in various types of combat transport media.

T.R. 206. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container IV - Design and Evaluation of Load Configurations for the Individual Combat Meal. M. A. Venetos, October 1959, 30 p. il. (AD-234046). QMFCIAF Report 28-59. 96.

This study deals with the design and evaluation of load configurations of the individual combat meal for airdrop in the M-4A high speed aerial delivery container.

T.R. 211. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container V - Design and Evaluation of Inert Small Arms Ammunition Load Configurations. M. A. Venetos, February 1960, 39 p. 13 il. (AD-239879). QMFCIAF Report No. 3-60. 97.

Analysis was made of methods of loading inert caliber 30 M-1 rifle and carbine ammunition into the M-4A high speed aerial delivery container. Factors considered were resistance to damage, space utilization, ease of loading and distribution. A method of predicting the performance of a system to be airdropped is described. Load configurations developed performance satisfactorily at an impact velocity of 35 feet per second. By using paper honeycomb in the cargo compartment, drop velocities of 50 feet per second for the caliber 30 carbine ammunition loads and 57 feet per second for caliber 30 M-1 rifle ammunition loads were attained without damage to the loads.

T.R. 213. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container VI- Design and Evaluation of Load Configurations for Meals, Quick-Serve, 6-Man and 25-Man. SP/4 C. Barpoulis and M.E. Kerley, March 1960, 26 p. 15 il. (AD-239878). QMFCIAF Report No. 4-60. 98.

Analysis was made of load configurations for 6-in-1 and 25-in-1 dehydrated rations in M-4A high speed aerial delivery container. Resistance to damage, space utilization and ease of loading were deciding factors in determining types of load configurations to be used. Shock ratings were used to predetermine if damage would occur when loads were dropped in M-4A container. A system was developed whereby 16 of the 6-in-1 rations could be dropped in container at design impact velocity and at higher velocities. Unless modifications were introduced to protect the high-vacuum-packed cans of bread and date pudding, three standard pack 25-in-1 rations could not be dropped successfully at the design impact velocity.

T.R. 217. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container VII - Design of Protective System for Aerial Delivery of AN/GRC-3 Radio Set in the M-4A Container. M. A. Venetos, June 1960, 51 p. 30 il. (AD-244297). QMFCIAF Report No. 12-60. 99.

A protective system was developed for the AN/GRC-3Radio Set and battery power supply for air dropping in the M-4A container at an impact velocity of 35 feet per second. Component tests were run on most fragile parts of the set (electron tubes) in order to obtain initial information on impact resistance without exposing the entire set to severe damage. Final evaluation of the systems was accomplished by making simulated airdrops in the elevator drop-shaft.

T.R. 219. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container VIII - Design and Evaluation of Load Configurations for Medical Supplies. M. A. Venetos, July 1960, 42 p. il. (AD-244-334). QMFCIAF Report No. 19-60. 100.

Load configurations of medical supplies to be airdropped in the M-4A high speed aerial delivery container were designed, developed, and evaluated. Medical supplies consisted of Individual and Combat Surgical Instrument and Supply Sets, also a kit recommended by the Surgeon General's Office. The load configurations designed were successfully dropped in the elevator drop-shaft at impact velocities of 35 feet per second. By use of honeycomb energy absorbers, drops were made at velocities up to 58 feet per second.

T.R. 220. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container IX - Design and Evaluation of Load Configurations for Mixed Supplies. M. A. Venetos, March 1961, 40 p. 8 il. (AD-254454). QMFCIAF Report No. 4-61. 101.

Mixed supply load configurations were designed for airdrop in M-4A high speed aerial delivery container. Load configurations of rations, water, ammunition, and medical supplies were evaluated by simulated airdrops in elevator drop-shaft facility. Three load configurations performed satisfactorily when subjected to vertical impacting at velocities of 35 feet per second and topple tests simulating side impacting. By use of paper honeycomb energy absorbers in container cargo compartment, one load configuration was dropped at impact velocity of 46.8 feet per second without damage.

T.R. 222. Loading Instructions for the M-4A High Speed Aerial Delivery and Sealed Canister. A. S. Young, November 1960, 56 p. il. (AD-251277). QMFCIAF Report No. 40-60. 102.

Provides general information as well as detailed instructions regarding the loading of the M-4A high speed AD container and sealed canister. The load configurations covered include rations, small arms ammo, medical supplies, communications equipment, high explosive ammo, and mixed supply loads. Loading instructions covered not only loads dropped at the operational velocity (35 feet per second), but also loads dropped at velocities up to 58 feet per second.

T.R. 223. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container X High Explosive Ammunition Load Configurations. M. A. Venetos, June 1961, 35 p. 8 il. (AD-263799). QMFCIAF Report No. 8-61. 103.

Load configurations consisting of 81 mm mortar shells and 57 mm and 90 mm rifle cartridges were designed for the aerial delivery container. Shock ratings of ammunition were used in conjunction with graphs of the dynamic impact characteristcs of the M-4A nose cone to predict resistance to impact forces developed at impact velocities of 35 feet per second and higher. Simulated airdrops were made in the elevator drop-shaft facility to verify predicted performance.

T.R. 227. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container XI. - Load Configurations for Individual Combat Meals, Training Grenades (Inert), and Carbines and Ammunition. A. S. Young, E.H. Schembor, March 1962, 35 P. il. (AD-278585). QMFCIAF Report No. 8-62. 104.

Load configurations were developed for the three different loads in this study capable of withstanding forces due to impact velocities of 35 feet per second without the need for additional energy absorbers. With the addition of cushioning material, the load configurations of the ration and carbines with ammunition were found to be capable of withstanding higher impact velocities.

T.R. 238. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container XII - Load Configurations for Practice Hand Grenades and 30 caliber Browning Machine Guns with Associated Ammunition. E.J. Pulo, October 1962, 42 p. il. (AD-290471). QMFCIAF Report No. 36-62. 105.

Load configurations were developed for the two loads capable of withstanding forces due to impact velocities of 35 feet per second without the need for additional energy absorbers. With additional cushioning material, the loads were capable of withstanding higher impact velocities.

AERIAL DELIVERY ARTICLES

Art 5. Aerial Delivery Packaging. E. C. Myers, Proceedings, Seventh Annual Meeting, Research and Development Associates, Food and Container Institute, Inc., p. 41-42, June 1954. 106.

A general discussion of aerial delivery packaging for either free-fall or retarded-fall delivery and the objectives of Quartermaster research in aerial delivery.

Art 7. Introduction to Aerial Delivery Research at the Institute. R.H. Witting, Activities Report, 7: 118-122, July 1955.

A discussion of the Quartermaster Food and Container Institute's short- and long-range aerial delivery program.

Art 8. Characteristics to be Considered of Military Supplies and Equipment for Airdrop. R. H. Witting, Activities Report, 7: 206-12, October 1955. 107.

A discussion of the shock and impact characteristics of supplies and equipment based on the relationships existing among force, time, and distance.

Art 9. Cushioning for High Velocity Impact. E. F. Williams, Packaging Engineering, 1: no. 6, p. 7-11, June 1956.

A discussion of the use of cushioning materials for aerial delivery packaging.

Art 10. Preparation of Supplies and Equipment for Airdrop. R. H. Witting, Activities Report, 7: 273-275, January 1956. 108.

The present state of knowledge regarding preparation of materiel for airdrop, and what is being done to improve that knowledge.

Art 11. Airdrop Phenomena. E. F. Williams, Activities Report, 8: 76-83, April 1956.

A discussion of workable airdrop systems that require a minimum of time in preparation, specialized equipment and money.

Art 12. Aerial Delivery Test Facilities at QMFCIAF. E. F. Williams, Activities Report, 8: 149-154, July 1956.

A description of the test facilities and instrumentation at the Quartermaster Food and Container Institute applicable to aerial delivery research.

Art 13. Supply from the Sky. B. H. Roffee, Fiber Container and Paperboard Mills, 41: no. 10, 40-44, October 1956; Activities Report, 8: 220-228, October 1956; Modern Materials Handling, 11: no. 12, 104-106, December 1956, (entitled: Let packages bounce -- safely); Quartermaster Review, 36: no. 5, 14-15, 147-148, March-April 1957, (rewritten by Maj. Cecil W. Hospelhorn under title: High Velocity Airdrop System). 111.

Research involved in the design of a high velocity aerial delivery system for C-rations.

Art 19. Design of Load Configurations for the M-4A High Speed Aerial Delivery Container. M.A. Venetos, Activities Report, 11: 242-245, December 1959. 112.

The concept and reason for aerial delivery is discussed along with the test facilities used for conducting simulated field tests used at the QMFCIAF.

Art 24. Considerations in Designing Load Systems for the M-4A Aerial Delivery Container. M.A. Venetos, Activities Report, 12: 248-251, December 1960. 113.

Evaluation of load configurations for different type loads and the various principles and techniques developed for loading items to withstand higher impact forces are discussed.

Art 26. Studying Load System Aerial Delivery Problem. M.A. Venetos, Army Research and Development, 2: no. 10, p. 18, October 1961. 114.

A description of the facilities and an evaluation of the progress of aerial delivery research being conducted at the QMFCIAF.

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